CLAIMS

What is claimed is:

1. A method comprising:

transmitting a current with a transmitter;

transmitting a bucking current with a bucking device;

calculating the bucking current for a selected sub-array;

wherein the calculated bucking current is different from the current transmitted by the transmitter; and

wherein the calculated bucking current is transmitted concurrently with the current transmitted by the transmitter.

2. The method of claim 1, wherein the bucking current is pre-calculated.

3. The method of claim 1, wherein the bucking device is separated from a receiving device by a predetermined distance.

4. The method of claim 1, further comprising varying the bucking current to accommodate a plurality of receiving devices.

5. The method of claim 4, further comprising selecting a single receiving device from the plurality of receiving devices and varying the bucking current based on the selected receiving device.

6. A well-logging tool, comprising:

a transmitter disposed on the logging tool;

a plurality of receivers disposed on the logging tool; and

a bucking device disposed on the logging tool;

wherein the bucking device adaptively cancels a signal induced in at least one of the transmitter or the plurality of receivers.

7. The well-logging tool of claim 6, wherein the bucking device comprises any one of an electrode and a coil.

8. The well-logging tool of claim 6, wherein the transmitter comprises any one of an electrode and a coil.

9. The well-logging tool of claim 6, wherein each receiver in the plurality of receivers comprises any one of an electrode and a coil.

10. The well-logging tool of claim 6, wherein each receiver in the plurality of receivers comprises any one of a three-component receiver and a single-component receiver.

11. The well-logging tool of claim 6, wherein the bucking device comprises a bucking coil and the transmitter comprises a transmitting coil and the bucking coil and the transmitting coil are wound around a desired axis in opposite directions.

12. The well-logging tool of claim 6, wherein the transmitter and each receiver in the plurality are separated by predetermined distances and the predetermined distances are different for each receiver in the plurality.

13. The well-logging tool of claim 6, wherein the plurality of receivers receive signals and at least a portion of the received signals comprise signals directly coupled from the transmitter, and wherein the bucking device minimizes the magnitude of the signal that is directly coupled from the transmitter to the plurality of receivers.

14. The well-logging tool of claim 13, wherein minimizing the magnitude is determined by an amount of current in the bucking device.

15. The well-logging tool of claim 13, wherein the current in the bucking device is varied according to a receiver selected from the plurality of receivers in order to minimize the direct coupling.

16. A method of induction well-logging comprising:

transmitting a first signal with a transmitter;

receiving a second signal with a receiver, wherein the second signal comprises a first portion and a second portion, wherein the first portion is directly coupled from the transmitter and the second portion is indirectly coupled from the transmitter; and

transmitting a third signal with a bucking device simultaneously with the first signal, wherein the third signal minimizes the magnitude of the first portion of the second signal and wherein the magnitude of the third signal is different from the magnitude of the first signal.

17. The method of claim 16, wherein a current in the bucking device is pre-calculated.

18. The method of claim 17, further comprising varying the current in the bucking device to accommodate a plurality of receivers.

19. The method of claim 16, wherein the receiver comprises any one of a three-component receiver and a single-component receiver.

20. The method of claim 16, wherein the bucking device is separated from the receiver by a predetermined distance.

21. A well-logging tool, comprising:

a first sub-array comprising a transmitting coil, a bucking coil, and a first receiving coil;

a second sub-array comprising the transmitting coil, the bucking coil, and a second receiving coil;

wherein, the first and second receiving coils receive signals that are directly coupled from the transmitting coil and signals that are indirectly coupled from the transmitting coil; and

wherein the bucking coil minimizes the magnitude of the signals that are directly coupled from the transmitting coil to the receiving coil.

22. The well-logging tool of claim 21, wherein the minimization of the magnification provided by the bucking coil is determined by a current in the bucking coil.

23. A well-logging tool comprising:

a current controlling device;

a transmitting coil coupled to the current controlling device;

a bucking coil coupled to the current controlling device; and

a plurality of receiving coils, wherein the current controlling device selectively couples to at least one receiving coil within the plurality of receiving coils;

wherein the current controlling device provides current to the bucking coil and wherein the amount of current provided to the bucking coil depends on which receiving coil is selected by the current controlling device.

24. The well-logging tool of claim 23, wherein the current controlling device provides pre-determined amounts of current to the bucking coil based on which receiving coil is selected.

25. The well-logging tool of claim 23, wherein the current controlling device further comprises a look-up table that is pre-configured to provide current values for the bucking coil based on the various receiving coils within the plurality of receiving coils.

26. The well-logging tool of claim 23, wherein the look-up table is pre-programmed for varying arrangements of receiving coils.

27. The well-logging tool of claim 23, wherein the current controlling device dynamically provides a plurality of current values.

28. A method of induction logging, comprising:

providing a signal with a transmitting coil;

receiving the signal with a plurality of receiver coils, wherein the signal received by each receiver coil comprises a first portion that is directly coupled from the transmitting coil and a second portion that is indirectly coupled from the transmitting coil;

providing a current to a bucking coil with a current controlling device, wherein the current controlling device selectively couples to at least one receiver coil in the plurality; and

varying the current provided to the bucking coil.

29. The method of claim 28, wherein the current provided to the bucking coil is varied based on which receiver coil the current controlling device is coupled to.

30. The method of claim 28, further comprising minimizing the magnitude of the first portion of the received signal using the bucking coil.

31. The method of claim 28, wherein the current in the bucking coil is determined by:

$$I_B = -\left(\frac{L_B}{L_T}\right)^3\left(\frac{N_T S_T}{N_B S_B}\right) I_T$$

wherein L_B is the distance from the bucking coil to the receiving coils, L_T is the distance from the transmitting coil to the receiving coils, N_B is the number of windings in the bucking coil, and N_T is the number of windings in the transmitting coil, S_B is the cross sectional area of the bucking coil, and S_T is the cross sectional area of the transmitting coil.

32. A well-logging tool comprising:

a current controlling device;

a transmitting coil coupled to the current controlling device;

a bucking coil coupled to the current controlling device; and

a plurality of receiving coils, wherein each receiver coil is adapted to receive a signal from the transmitting coil at a predetermined frequency and wherein the signal received by the receiver coil comprises a first portion that is directly coupled from the transmitting coil and a second portion that is indirectly coupled from the transmitting coil;

wherein the current controlling device provides a current to the bucking coil and wherein the current provided to the bucking coil corresponds to the predetermined frequencies associated with each receiving coil in the plurality.

33. The well-logging tool of claim 32, wherein the current provided to the bucking coil is provided by:

$$I_B(f_i) = -b_i \cdot I_T(f_i), \quad i = 1, 2, ..., N$$

wherein $I_T(f_i)$ is the current in the transmitting coil due to the i-th receiving coil at frequency f_i, and $I_B(f_i)$ is the current in the bucking coil due to the i-th receiving coil at frequency f_i, and b is a bucking coefficient given by

$$b_i = -\left(\frac{N_T S_T}{N_B S_B}\right)\left(\frac{L_B^i}{L_T^i}\right)^3, \quad i = 1,2, \ldots, N; \text{ and}$$

wherein L^i_T corresponds to the spacing between the transmitting coil and the receiving coil, and L^i_B corresponds to the spacing between the receiving coil and bucking coil and , N_T is the number of windings of the transmitting coil, N_B is the number of windings in the bucking coil, S_B is the cross sectional area of the bucking coil, and S_T is the cross sectional area of the transmitting coil.

34. The well-logging tool of claim 32, wherein the total bucking current is determined by:

$$I_{total\_B} = \sum_{i=1}^{N} I_B^i(f_i).$$

35. The well-logging tool of claim 32, wherein the bucking coil transmits a composite signal related to the frequencies of at least two receiving coils.

36. The well-logging tool of claim 32, wherein the composite signal minimizes the magnitude of the first portion of the received signal in the receiving coils.

37. The well-logging tool of claim 32, wherein the receiving coils comprise three-component coils and single-component coils.

38. The well-logging tool of claim 32, wherein the plurality of receiving coils are coupled to a bandpass filter.